ONKYO® SERVICE MANUAL

Europe Model
DIGITAL SYNTHESIZED
FM STEREO TUNER
Model T-909

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ONKYO®
AUDIO COMPONENTS

SPECIFICATIONS

Tuning Range:	87.50 ~ 103.95MHz	AM Suppression Ratio:	55 dB
Tuning increments:	50 kHz	Harmonic Distortion:	FM mono: 0.08% at 1 kHz
Usable Sensitivity:	FM mono: 9.8 dBf, 1.7μV IHF		FM stereo: 0.15% at 1 kHz
	1.3μV (S/N 26 dB,	Stereo Separation:	45 dB at 1 kHz
	40 kHz Devi.) DIN		40 dB at 100~10,000 Hz
	FM stereo: 17.2 dBf, 4μV IHF	Subcarrier Suppression:	70 dB
	45μV (S/N 46 dB,	Muting Level:	17.2 dBf, 4μV
	40 kHz Devi.) DIN	Stereo Threshold:	17.2 dBf, 4μV
50 dB Quieting Sensitivity:	FM mono: 14.7 dBf, 3μV	Frequency Response:	30~16,000 Hz (+0.5, −2dB)
	FM stereo: 36 dBf, 35μV	Tuning Frequency Accuracy:	30 ppm
Intermediate Frequency:	10.7 MHz	Power Supply Rating:	AC220 volts 50 Hz
Capture Ratio:	1.5 dB	Antennas:	300 ohms balanced, 75 ohms
Image Rejection Ratio:	85 dB		unbalanced and 75 ohms type
IF Rejection Ratio:	100 dB		"F" connector
Spurious Rejection Ratio:	105 dB	Semiconductors:	4 FETs, 56 ICs
Signal to Noise Ratio:	FM mono: 80 dB		49 Transistors, 63 Diodes
	FM stereo: 74 dB	Dimensions:	450 W x 3 1/4" x 13 15/16"
Alternate Channel Att.:	80 dB IHF	Weight:	5.9 kg., 13.0 lbs.
Selectivity:	75 dB DIN		
	(±300 kHz, 40 kHz Devi.)		

Specifications and features are subject to change without notice.

PRECAUTIONS

All CMOS devices have diode input protection against adverse electrical environments such as static discharge.

Unfortunately, there can be severe electrical environments during the process of handling. For example, static voltages generated by a person walking across a common waxed floor have been measured in the 4 to 15 kV range (depending on humidity, surface conditions, etc.). These static voltages are potentially disastrous when discharged into a CMOS input considering the energy stored in the capacity ($\approx$300 pF) of the human body at these voltage levels.

Present CMOS gate protection structures can generally protect against overvoltages. This is usually sufficient except in the severe cases. Following are some suggested handling procedures for CMOS devices, many of which apply to most semiconductor devices.

1. All MOS devices should be stored or transported in materials that are somewhat conductive. MOS devices must not be inserted into conventional plastic "snow" or plastic trays.
2. All MOS devices should be placed on a grounded bench surface and operators should ground themselves prior to handling devices, since a worker can be statically charged with respect to the bench surface.
3. Nylon clothing should not be worn while handling MOS circuits.
4. When lead straightening or hand soldering is necessary, provide ground straps for the apparatus used.
5. Double check test equipment setup for proper polarity of voltage before conducting parametric or functional testing.
6. All unused device inputs should be connected to V_{DD} or V_{SS}.

FEATURES

Quartz Controlled Tuning Accuracy

Onkyo has solved tuning accuracy problems once and for all by employing one of the most accurate and stable reference frequency sources known today - the quartz crystal oscillator in a quartz synthesizer tuning system. Not even the slightest hint of station drift can be detected, irrespective of widely varying operational conditions.

Front Panel Digital Frequency Display

Befitting its high degree of tuning accuracy and stability, the T-909 displays the tuned frequency in digital form. Tuning operations involve no more than the pushing of a few buttons - nothing could be simpler, nor any more accurate.

Frequencies may be varied one at a time in 50 kHz steps (200 kHz steps for USA) or continuously at relatively high speed. And when the station has been accurately tuned, the TUNED indicator lamp will light up.

Tuning Memory for Automatic Tuning

A total of 7 favorite FM stations may be pre-set for automatic tuning. The actual setting operation involved is simplicity itself, while any pre-set memory may be cleared and reset for a new station with equal ease.

High Sensitivity Plus Superb Selectivity

With dual gate MOS FETs in the front-end RF stage and mixer circuit, and a tuned buffer circuit in the local oscillator, a truly excellent FM sensitivity of 1.7 μV (9.8 dBf) has been attained. Distant FM stations that were once too remote for worthwhile FM listening are given greater clarity and brilliance. But what is even more remarkable is the conspicuous absence of interference, especially from adjacent stations.

Negligible Noise and Distortion
Although the T-909 has been designed for the ultimate in accuracy and speed, emphasis is also on quality of sound reproduction. An S/N ratio of 80 dB (mono) and a distortion rating of 0.08% (mono, 1 kHz) clearly reveal the extremely high standard of hi-fi FM reception achieved in the T-909.

Other Outstanding Features
As could be expected of a tuner of this class, space does not permit details on the numerous other important features, such as the PLL MPX IC and pilot cancellor, signal strength meter, de-emphasis switch for Dolby * broadcasts, multipath detector terminals (for oscilloscope connection) and the gold-plated output terminals.

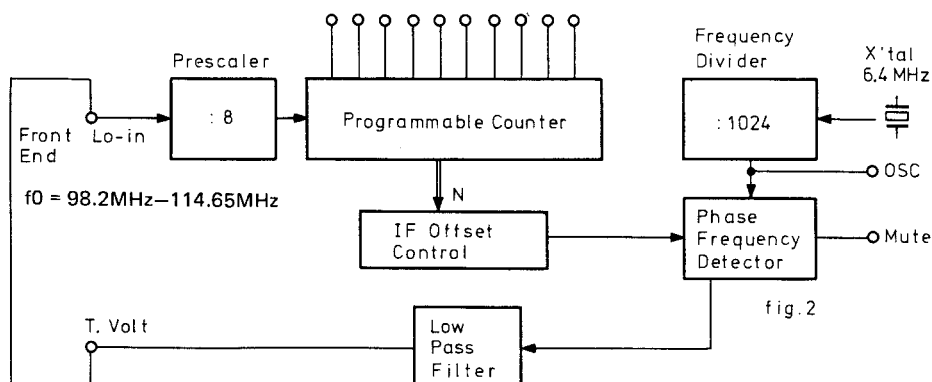* "DOLBY" IS A REGISTERED TRADEMARK OF DOLBY LABORATORIES INC.

CIRCUIT DESCRIPTION

T-909 BLOCK DIAGRAM
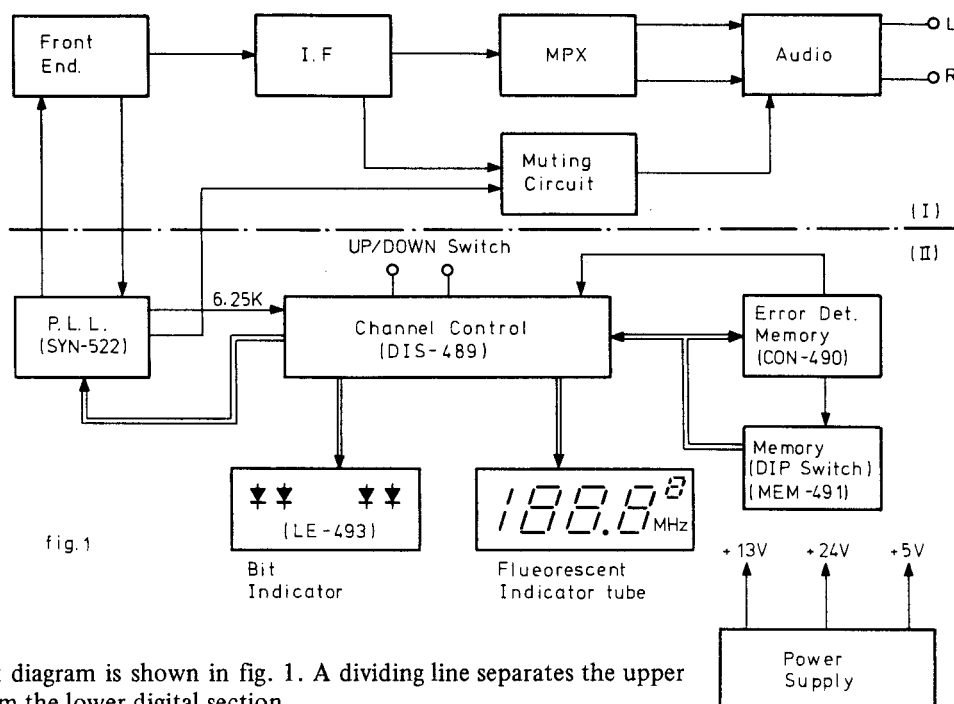
fig.1

The T-909 blook diagram is shown in fig. 1. A dividing line separates the upper linear section from the lower digital section.

SYN-522 BLOCK DIAGRAM

fig.2

In conventional tuners, radio stations are "tuned" by varying the capacitance of a variable capacitor. In digital tuners, however, this tuning operation is achieved by varying the voltage applied to a variable capacitance diode. In the PLL circuit (block diagram shown in fig. 2) , the subdivided oscillator frequency and a reference frequency undergo phase comparison to obtain the voltage to be applied to the variable capacitance diode.
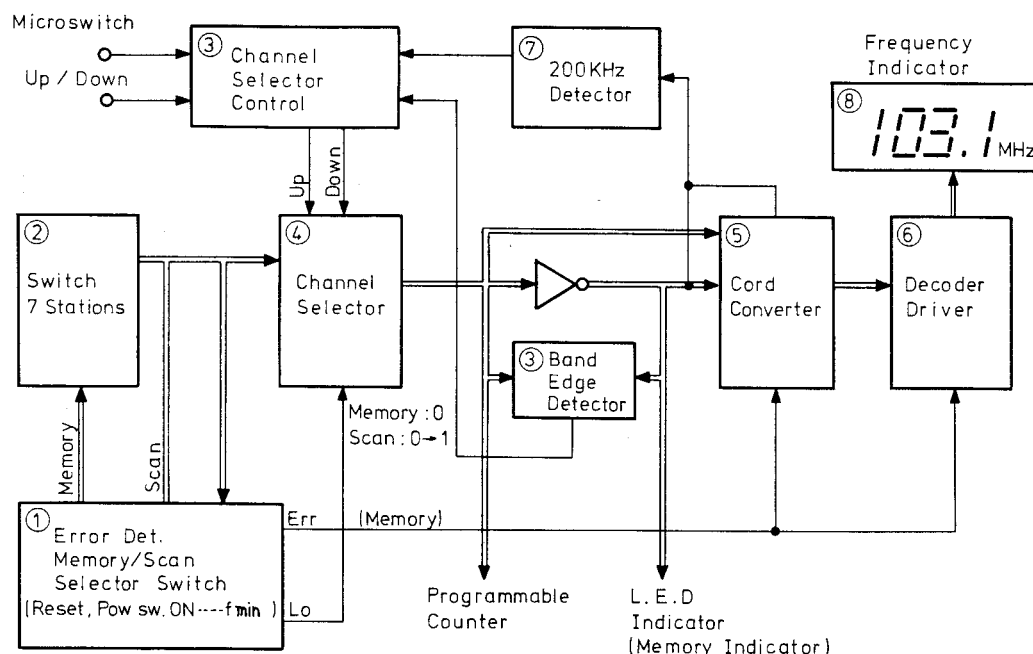
1. Memory/Scan Selector Switch and Error Detector Circuit

   The memory/scan selector switch contains 7 memory switching positions and 1 scan switching position.
   The Lo terminal is O during "memory", but changes to 1 during "scan" when the scan frequency is stored in the channel selector by the time constant circuit.
   The error detector circuit is activated whenever the code set by the memory DIP switch does not correspond to the code determined by the received frequency, resulting in the fluorescent E (Error) indicator lamp lighting up.

2. DIP Switch

   By setting the DIP switch (tuned manually to light up the LED lamp) to the code determined by the received frequency, the frequency will be recalled from memory by pressing the switch.

3. Channel Selector Control

   Scan pulse signals appear at the output whenever the UP or DOWN switches are pressed. Note, however, that the band edge detector is activated when either fmax (103.95MHz)or fmin (87.5 MHz) is reached, thereby stopping the output scan pulse signals.

4. Channel Selector

   The input code is passed straight through to the output during memory mode, but when the scan switch is on, the code set by CON-490 (fmin = 87.5 MHz) is stored in the memory. That is, the input signal appears at the output when Lo is O.
   The code which has been stored in the memory by the scan pulse signal from the channel selector control then changes the received frequency by advancing or delaying. the counter. Frequency is changed by 50 kHz per scan pulse.

5. Code Converter

   The channel selector output code is distributed io each frequency unit column (100MHz, 10MHz, 1MHz, and 100 kHz), and then converted into binary numbers corresponding to decimal numbers.

6. Decoder/Driver

   The code converted into binary form is then converted into a code form employed to drive the fluorescent indicator lamps. The 12.5 V drive voltage for these indicator lamps (the rest of the digital section employs high level voltage in the 3 to 5 V range) is obtained from the inverter C-MOS IC acting as a driver circuit.

7. 200 kHz Detector Circuit

   Frequencies in the European model are changed in steps of 50 kHz, but in the USA model frequencies are changed in steps of 200 kHz. And since the channel selector counter is advanced or delayed by 50 kHz per step, the USA model is equipped with a 200 kHz detector circuit in order to advance or delay the channel selector counter 4 counts at a time.
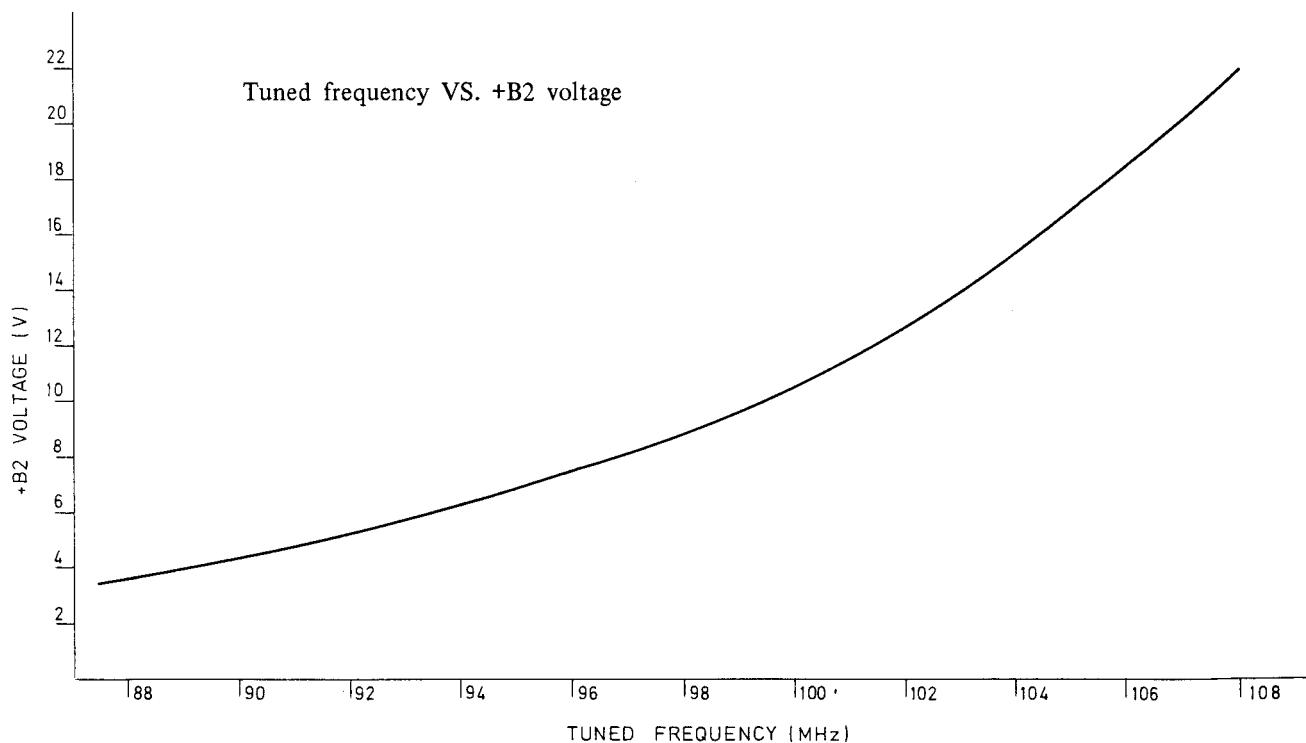
Tuned frequency and channel selector output cords

Frequency (MHz)	J	I	H	G	F	Frequency (MHz)	E	D	C	B	A
87	0	1	0	1	1	.00	0	0	0	0	0
88	0	1	1	0	0	.05	0	0	0	0	1
89	0	1	1	0	1	.10	0	0	0	1	0
90	0	1	1	1	0	.15	0	0	0	1	1
91	0	1	1	1	1	.20	0	0	1	0	0
92	1	0	0	0	0	.25	0	0	1	0	1
93	1	0	0	0	1	.30	0	0	1	1	0
94	1	0	0	1	0	.35	0	0	1	1	1
95	1	0	0	1	1	.40	0	1	0	0	0
96	1	0	1	0	0	.45	0	1	0	0	1
97	1	0	1	0	1	.50	1	0	0	0	0
98	1	0	1	1	0	.55	1	0	0	0	1
99	1	0	1	1	1	.60	1	0	0	1	0
100	1	1	0	0	0	.65	1	0	0	1	1
101	1	1	0	0	1	.70	1	0	1	0	0
102	1	1	0	1	0	.75	1	0	1	0	1
103	1	1	0	1	1	.80	1	0	1	1	0
104	1	1	1	0	0	.85	1	0	1	1	1
105	1	1	1	0	1	.90	1	1	0	0	0
106	1	1	1	1	0	.95	1	1	0	0	1
107	1	1	1	1	1						

Band Edge Control Cords

	J	I	H	G	F	E	D	C	B	A
UP	1	1	0	1	1	1	1	0	0	0
DOWN	0	1	0	1	1	1	0	0	1	0

NOTES: The frequency when set the power switch to ON or the tuned switch to reset is 87.5MHz

Tuned frequency VS. +B2 voltage

+B2 VOLTAGE (V)

TUNED FREQUENCY (MHz)

EXPLODED VIEW

EXPLODED VIEW-PARTS LIST

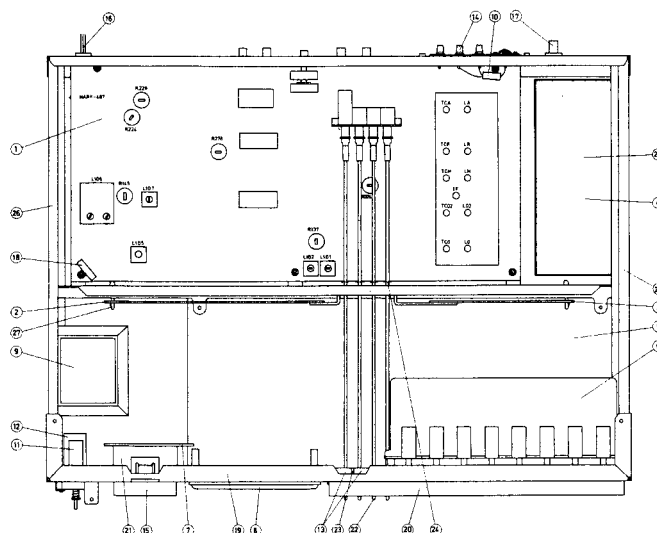| Ref. No.	Parts No.	Description
1	2811044	Top cover
2	831430082	3STW+8BQ (BC)
3	27170042	Bottom board
4	280379	Leg
5	834130122	3STS+12BQ
6	831130082	3STW+8BQ
7	28320168A-1	Power switch knob
8	28133008	Plate
9	28191026	Smoking plate
10	28140102	Cushion
11	28140103	Cushion
12	225018	GL-2PR1, Stereo indicator L.E.D.
13	225019	GL2PG1, Tuned indicator L.E.D.
14	13752593	NALE-493, L.E.D. P.c.b.
15	13752591	NAMEM-491, Memory p.c.b.
16	13752121	Front panel ass'y
17	87313006	M-3B
18	831130082	3STW+8BQ
19	27300107	Programming stylus
20	27120116	Back panel
21		Plate (M)
22	28142602	Cushion

FRONT PANEL-EXPLODED VIEW
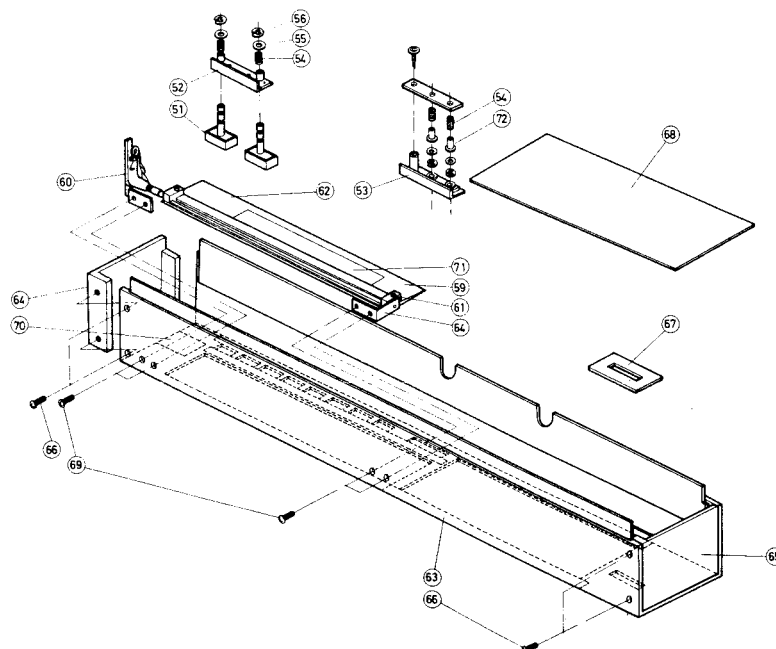
FRONT PANEL EXPLODED VIEW-PARTS LIST

Ref. No.	Parts No.	Description	Ref. No.	Parts No.	Description
51	28320240	Push switch knob	62	27300105	Support (R)
52	27267028	Push switch guide	63	27210096	Front panel
53	27267029	Push switch guide	64	28125038-1	End cap (R)
54	27180021	Spring	65	28125037-1	End cap (L)
55	87644010	W4+10F (BC)	66	8233006	3S+6FN (CR)
56	893030	E-3, Circlip	67	27267018	Power switch guide
57	27140201	Bracket	68	28191025	Dial glass
58	834130062	3STS+6BQ	69	82113006	3P+6FN
59	28148050	Door	70	28140106	Cushion
60	27300110	Hinge (R)	71	29380041	Label (A)
61	27300106	Support (L)	72	27270017A	Spacer

COMPONENT LOCATION

COMPONENT LOCATION-PARTS LIST

| Ref. No.	Circuit No.	Parts No.	Description
1		13752587	NARF-487, RF/IF and MPX. pc board
2		13752585	NAPS-485, Power supply pc board
3		13752586	NAPS-486, Power supply pc board
4		13752522	NASYN-522, Synthesis pc board
5		13752589	NADIS-489, Display pc board
6		13752590	NACON-490, Converter pc board
7		13752592	NAPL-492, Meter illumination pc board
8	Q747	212001	5-LT-06, Fluorescent indicator tube
9	T001	230244	NPT-646G, Power transformer
10	T002	233026	NBLN-1, Balun transformer
11	C1	3500052	PME271Y510CEE, IS capacitor
12	S001	25035054	NPS-111-L19P, Power switch
13	S811, S812	25065051	NMS-1202, Microswitch
14		25060021B	NTM-3PUM1, Antenna terminal
15		243088	NIND-0500S88, Signal strength meter
16		253072	Power supply cord
17		25045012	FR3, Coaxial connector
18		25108002	MD2R, Terminal
19	A001	27110057	Front bracket
20	A005	27110058	Front bracket (R)
21	A002	27250015	Lamp case
22	A032	27260014	Shaft
23	A014	27140200	Bracket
24	A033	893020	E-2, Shaft
25	A021	27115032	Side bracket (R)
26	A022	27115033	Side bracket (L)
27	A029	27190009	Holder
28	A036	27150081	Shielded cover

ALIGNMENT PROCEDURES

INSTRUMENTS REQUIRED

1. Stereo Modulator
2. FM Signal Generator with Frequency Counter
3. Frequency Counter
4. Digital DC Voltmeter
5. DC Voltmeter
6. Distortion Analyzer
7. AC V.T.V.M.
8. Oscilloscope

GENERAL ALIGNMENT CONDITION

1. Standard modulation is 1 kHz 100% (FM MONO), pilot 9% sub and main 91% (FM STEREO).
2. Standard knob position
   S1 (DOLBY NR ADAPT) .... OFF
   S2 (NOISE FILTER) .... OFF
   S3 (MODE) .... STEREO
   S4 (MUTING) .... OFF

CONNECTION DIAGRAM
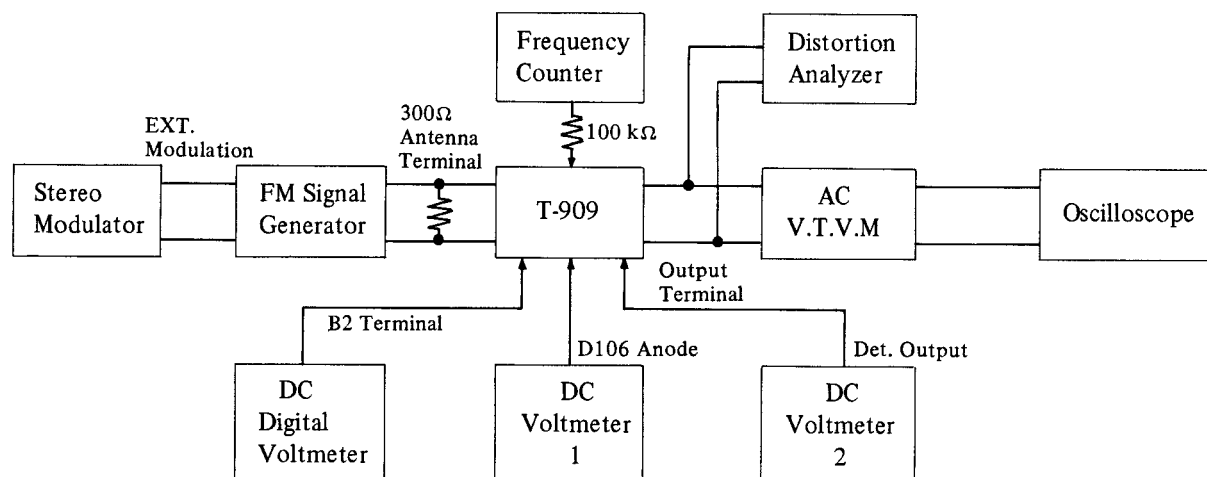
(1) FM ALIGNMENT

| Step	FM Signal Generator	Stereo Modulator	Dial to set	Adjust	Output Indicator	Adjust for	Remarks
1	88.1MHz, 65dBf 1kHz 75kHz devi.	——	88.1MHz	LO	DC Digital Voltmeter	3.6V	Usally not necessary to adjust
2	103.9MHz, 65dBf 1kHz, 75kHz devi.	——	103.9MHz	TCO		15.4V	
3	88.1MHz, 25dBf 1kHz, 75kHz devi.	——	88.1MHz	L001 ? L004	DC Voltmeter 1	Minimum	Repeat steps 3 and 4 as necessary
4	103.9MHz, 25dBf 1kHz, 75kHz devi.	——	103.9MHz	TC001 ? TC004			
5	98.1MHz, 25dBf 1kHz, 75kHz devi.	——	98.1MHz	L106			
6	98.1MHz, 25dBf 1kHz, 75kHz devi.	——	98.1MHz	L107 Bottom	DC Voltmeter 2	0V	
				L107 Upper	Distortion Analyzer	Minimum	
7	98.1MHz, 25dBf 1kHz, 75kHz devi	——	98.1MHz	L105	AC V.T.V.M	Maximum	
8	98.1MHz, 65dBf EXT. Modulation	L+R 68.25kHz devi. Pilot sig. 6.75kHz devi.	98.1MHz	L101 L102	Distortion Analyzer	Minimum	

(2) MULTIPLEX ALIGNMENT

	FM Signal Generator	Stereo Modulator	Dial to set	Adjust	Output Indicator	Adjust for	Remarks
V.C.O	98.1MHz 65 dBf	————	98.1MHz	R224	Frequency Counter	76kHz	Turn off the modulation
Pilot Cancel	98.1MHz 65dBf EXT. Modulation	Pilot Sig. 6.75kHz devi.	98.1MHz	R229	AC V.T.V.M	Minimum	
Separation	Same as above	Rch 68.25kHz devi. Pilot 6.75kHz 6.75kHz	98.1MHz	R278	AC V.T.V.M (Lch)	Minimum	Maximum and same Separation
		Lch 68.25kHz devi. Pilot 6.75kHz devi.			AC V.T.V.M (Rch)	Minimum	

(3) MUTING CIRCUIT

FM Signal Generator	Dial to set	Adjust	Output Indicator	Adjust for	Remarks
98.1MHz. 17dBf	98.1MHz	R145	Oscilloscope	Signal	Set the muting
98.1MHz. 16dBf				No Signal	Switch to ON.
98.1MHz, 65dBf 1kHz, 75kHz devi.	98.1MHz	R324	DC Voltmeter	Same Voltage	Connect the DC Voltmeter across the gates of Q_{321}

(4) SIGNAL STRENGTH METER CALLIBRATION

FM Signal Generator	Dial to set	Adjust	Output Indicator	Adjust for
98.1MHz, 65dBf 1kHz, 75kHz devi.	98.1MHz	R139	Signal Strength Meter	60

Adjustment Point
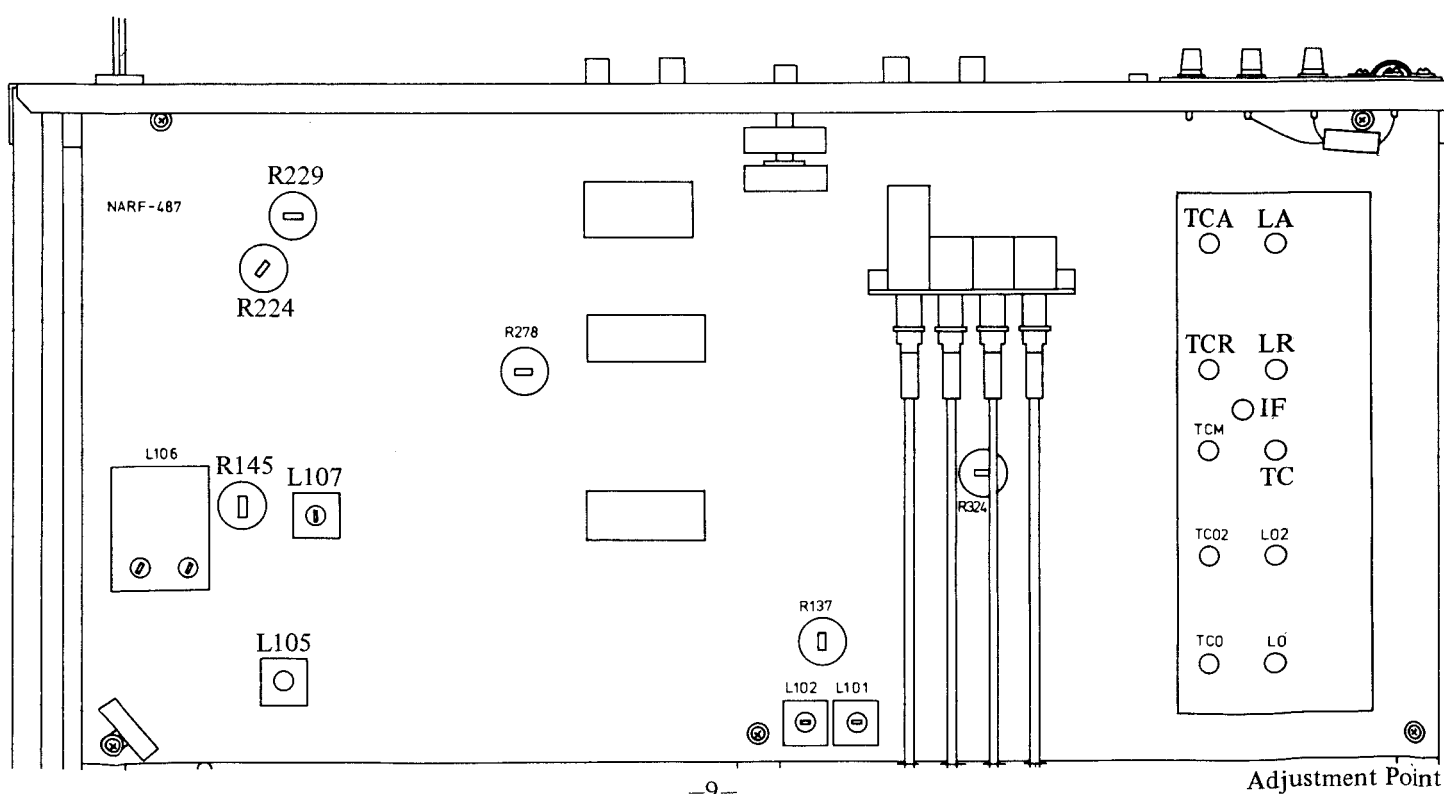
DIGITAL SECTION P.C.B.-PARTS LIST

SYNTHESIS PC BOARD
(NASYN-522)-PARTS LIST

Circuit No.	Parts No.	Description
ICs		
Q761	222495	HD74S112
Q762	222484	HD74S74
Q763	222493	SN74LS192
Q764, Q765	222494	SN74LS193
Q766	222479 or 222442	HD7427 or SN7427
Q767	222488 or 222428	HD7420 or SN7420
Q768, Q769	222491	HD74293
Q770	222501	HD7474
Q771	222477	TC5081
Transistors		
Q772	2211192	2SC380A(O)
Q773, Q774	2210675	2SC1681(GR)
Capacitor		
C761	3500056	1μF, 16V, CA
X'tal		
X801	3010029	XTL-6.4M
Shielded case		
	27225027	

DISPLAY PC BOARD
(NADIS-489)-PARTS LIST

Circuit No.	Parts No.	Description
ICs		
Q701-Q704	222478	HD7400
Q706	222481	HD7410
Q707	222487	HD74192
Q708, Q709	222492 or 222504	HD74193 or SN74193
Q710, Q711	222489	HD7430
Q712	222490 or 222505	HD7486 or M53286
Q713	222481	HD7410
Q714	222478	HD7400
Q715	222480	HD7432
Q716, Q718	222481	HD7410
Q717, Q719 Q720, Q722	222478	HD7400
Q721, Q723	222481	HD7410
Q724, Q725	222503 or 222483	SN74LS47 or SN7447AN
Q726-Q728	222475	TC4049
Q729, Q730	222484	HD7404
Transistors		
Q731-Q746	2211255	2SC1815(GR)
Fluorescent indicator tube		
Q747	212001	5-TL-06
Diodes		
D701, D702	223105	1S1555
Capacitors		
C701	352722211	220μF, 6.3V, Elect.

Circuit No.	Parts No.	Description
C703	374122235	0.022μF±10%, 50V, DE
C704	352922206	22μF, 6.3V, NP
C708	352721011	100μF, 6.3V, Elect.
C713	352732202	22μF, 10V, Elect.
C714	352742201	22μF, 16V, Elect.

CONVERTER PC BOARD
(NACON-490)-PARTS LIST

Circuit No.	Parts No.	Description
ICs		
Q751, Q754	222478	HD7400
Q755	222481	HD7410
Transistors		
Q756, Q757	2211255	2SC1815(GR)
Diodes		
D711-D714 D718, D720	2231031	1N60N(FM)
Capacitor		
C731	352734701	47μF, 10V, Elect.
Switch		
	25035074	NPS-822-L39, Memory/Scan

MEMORY PC BOARD
(NAMEM-491)-PARTS LIST

Circuit No.	Parts No.	Description
Diode arries		
D731-D737	225016	DAN401
D741-D747	225017	DAN601
Switches		
S801-S807	25065043	NDS-10102, DIP

METER ILLUMINATION PC BOARD
(NAPL-492)-PARTS LIST

Circuit No.	Parts No.	Description
	210032	0.25A, 6.3V, Pilot lamp
	451731504	15Ω, 2W, MOF resistor

L.E.D. PC BOARD
(NALE-493)-PARTS LIST

Circuit No.	Parts No.	Description
D801-D810	225020	TLR122, L.E.D.

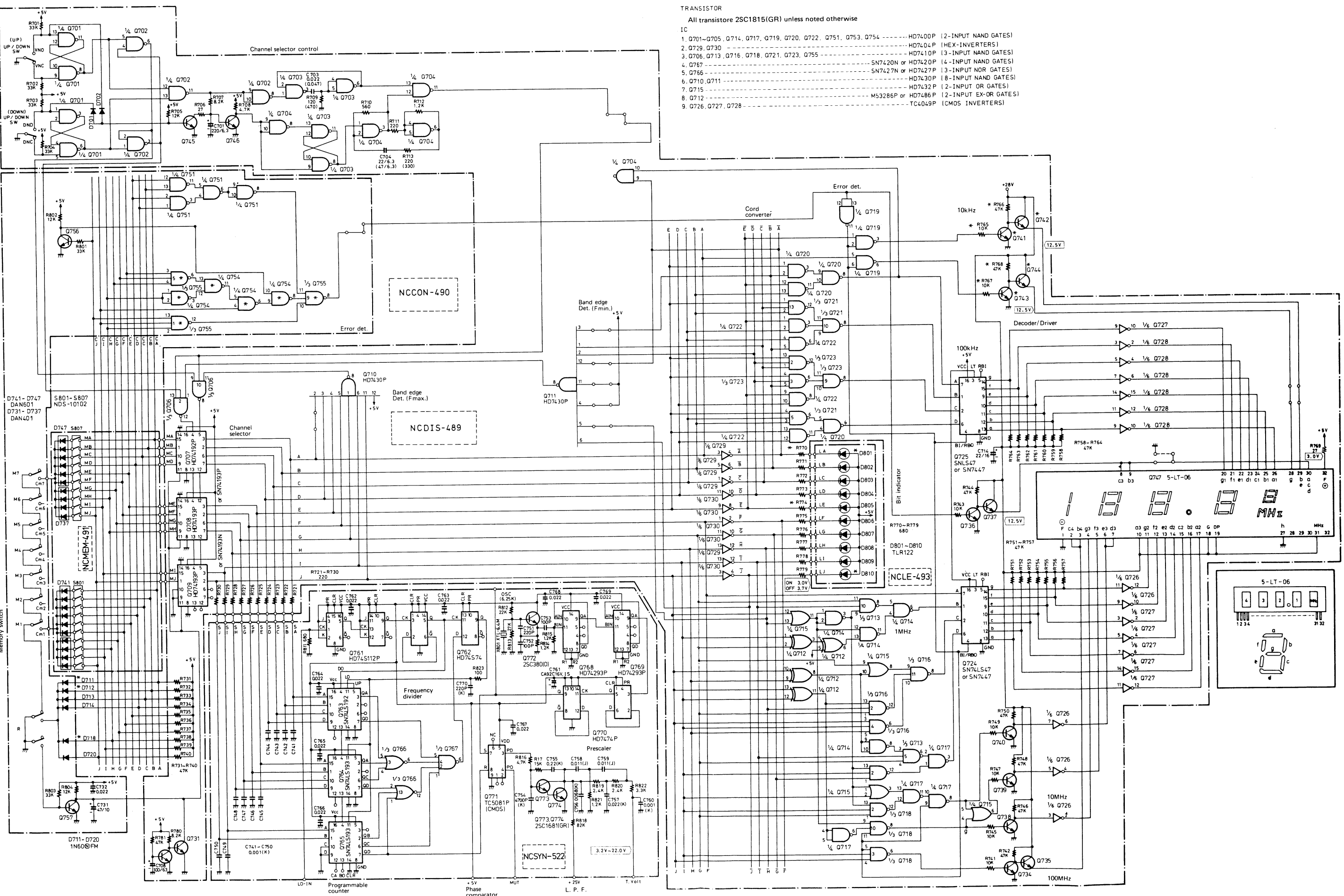NOTES: Capacitor
CA: Aluminum solid electrolytic capacitor
DE: Non-inductive polyester film capacitor
NP: Non-polar electrolytic capacitor
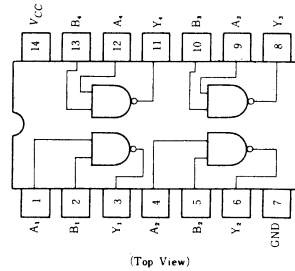   Resistor
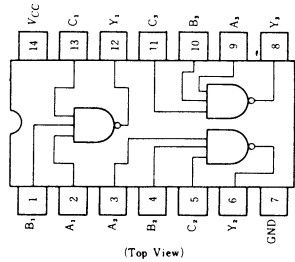MOF: Metal oxide film resistor

DIGITAL SECTION-SCHEMATIC DIAGRAM

PIN ARRANGEMENT FOR DIGITAL IC

HD7400
(Quadruple 2-input Positive NAND Gates)

(Top View)

HD7410
(Triple 3-input Positive NAND Gates)

(Top View)

SN7427, HD7427
(Triple 3-input Positive NOR Gates)

(Top View)
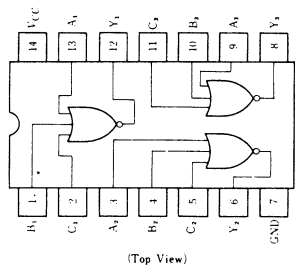
HD7432
(Quadruple 2-input Positive OR Gates)

(Top View)

HD7404
(Hex Inverters)

(Top View)

HD7420, SN7420
(Dual 4-input Positive NAND Gates)

(Top View)
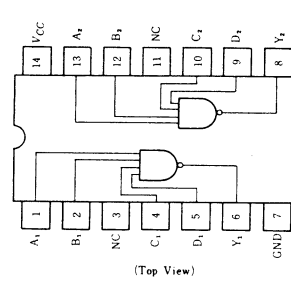
HD7430
(8-input Positive NAND Gates)

(Top View)
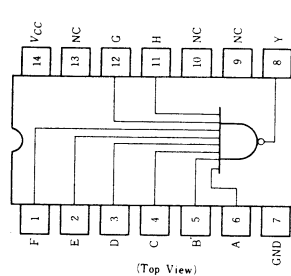
HD7486
(Quadruple 2-input Exclusive-OR Gates)
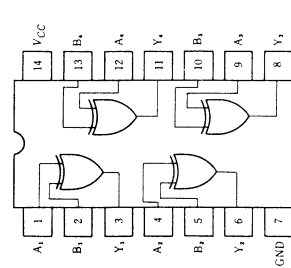
TRUTH TABLE

Input		Output
A	B	Y
0	0	0
0	1	1
1	0	1
1	1	0

HD7474
HD74S74
(Dual D-Type Edge-Triggered Flip-Flops)

BLOCK DIAGRAM

TRUTH TABLE

Inputs				Outputs	
PS	PC	CP	D	Q	$\bar{Q}$
0	1	×	×	1	0
1	0	×	×	0	1
0	0	×	×	1	1
1	1	↑	1	1	0
1	1	↑	0	0	1
1	1	0	×	Q_0	$\bar{Q}_0$

NOTES) 1. ↑: Transition from low to high level
2. The level of Q_0 before the indicated input conditions were established.
3. X: irrelevant

−13−

HD74S112
Dual J-K Negative Edge−Triggered Flip-Flops with Preset and Clear

(Top View)
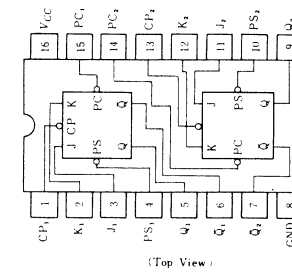
Input					Output	
PS	PC	CP	J	K	Q	$\bar{Q}$
0	1	×	×	×	1	0
1	0	×	×	×	0	1
0	0	×	×	×	1*	1*
1	1	↓	0	0	Q_0	$\bar{Q}_0$
1	1	↓	1	0	1	0
1	1	↓	0	1	0	1
1	1	↓	1	1	Toggle	
1	1	1	×	×	Q_0	$\bar{Q}_0$

NOTES: 1. X : irrelevant   2. ↓ : Transition from high to low level
3. The level of Q_0 before the indicated input conditions were established.
4. Toggle : Each output changes to the complement of its previous level on each active transition (pulse) of the clock.
5. * : This configuration is nonstable; that is, it will not persist when present and clear inputs return to their inactive (high) level.
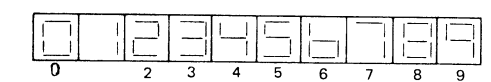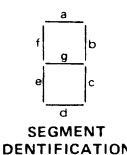
HD74LS293
Decade and 4-bit Binary Counter

'293, 'LS293
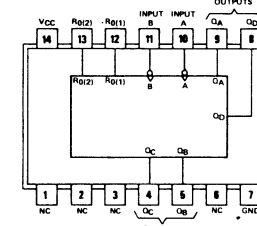
COUNT SEQUENCE

COUNT	OUTPUT			
	Q_D	Q_C	Q_B	Q_A
0	L	L	L	L
1	L	L	L	H
2	L	L	H	L
3	L	L	H	H
4	L	H	L	L
5	L	H	L	H
6	L	H	H	L
7	L	H	H	H
8	H	L	L	L
9	H	L	L	H
10	H	L	H	L
11	H	L	H	H
12	H	H	L	L
13	H	H	L	H
14	H	H	H	L
15	H	H	H	H

NOTE: Output Q_A is connected to input B

SN74LS47, SN7447
BCD-to-Seven-Segment Decoders/Drivers

SEGMENT IDENTIFICATION

NUMERICAL DESIGNATIONS AND RESULTANT DISPLAYS

FUNCTION TABLE

DECIMAL OR FUNCTION	INPUTS					BI/RBO†	OUTPUTS							NOTE
	LT	RBI	D	C	B	A		a	b	c	d	e	f	g	
0	H	H	L	L	L	L	H	ON	ON	ON	ON	ON	ON	OFF	
1	H	X	L	L	L	H	H	OFF	ON	ON	OFF	OFF	OFF	OFF	
2	H	X	L	L	H	L	H	ON	ON	OFF	ON	ON	OFF	ON	
3	H	X	L	L	H	H	H	ON	ON	ON	ON	OFF	OFF	ON	
4	H	X	L	H	L	L	H	OFF	ON	ON	OFF	OFF	ON	ON	
5	H	X	L	H	L	H	H	ON	OFF	ON	ON	OFF	ON	ON	
6	H	X	L	H	H	L	H	OFF	OFF	ON	ON	ON	ON	ON	
7	H	X	L	H	H	H	H	ON	ON	ON	OFF	OFF	OFF	OFF	
8	H	X	H	L	L	L	H	ON	ON	ON	ON	ON	ON	ON	
9	H	X	H	L	L	H	H	ON	ON	ON	OFF	OFF	ON	ON	
BI	X	X	X	X	X	X	L	OFF	OFF	OFF	OFF	OFF	OFF	OFF	2
RBI	H	L	L	L	L	L	L	OFF	OFF	OFF	OFF	OFF	OFF	OFF	3
LT	L	X	X	X	X	X	H	ON	ON	ON	ON	ON	ON	ON	4

H = high level, L = low level, X = irrelevant
NOTES: 1. The blanking input (BI) must be open or held at a high logic level when output functions 0 through 15 are desired. The ripple-blanking input (RBI) must be open or high if blanking of a decimal zero is not desired.
2. When a low logic level is applied directly to the blanking input (BI), all segment outputs are off regardless of the level of any other input.
3. When ripple-blanking input (RBI) and inputs A, B, C, and D are at a low level with the lamp test input high, all segment outputs go off and the ripple-blanking output (RBO) goes to a low level (response condition).
4. When the blanking input/ripple blanking output (BI/RBO) is open or held high and a low is applied to the lamp-test input, all segment outputs are on.
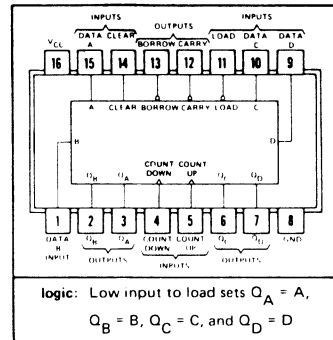†BI/RBO is wire-AND logic serving as blanking input (BI) and/or ripple-blanking output (RBO).

−14−

HD74192, SN74LS192, HD74193, SN74193, SN74LS193
Synchronous 4-bit Up/Down counters (Dual Clock with clear)

PIN ARRANGEMENT
(TOP VIEW)

logic: Low input to load sets Q_A = A,
Q_B = B, Q_C = C, and Q_D = D

DESCRIPTION

The 192 and LS192 circuits are BCD counters and the 193 and LS193 circuits are 4-bits binary counters.

The outputs of the four master-slave flip-flops are triggered by a low-to-high-level transition of either count (clock) input. The direction of counting is determined by which count input is pulsed while the other count input is high.

All four counters are fully programmable; that is, each output may be preset to either level by entering the desired data at the data inputs while the load input is low. The output will change to agree with the data inputs independently of the count pulses. This feature allows the counters to be used as modulo-N dividers by simply modifying the count length with the preset inputs.

A clear input has been provided which forces all outputs to the low level when a high level is applied. The clear function is independent of the count and load inputs. The clear, count, and load inputs are buffered to lower the drive requirements. This reduces the number of clock drivers, etc., required for long words.

These counters were designed to be cascaded without the need for external circuitry. Both borrow and carry outputs are available to cascade both the up- and down-counting functions. The borrow output produces a pulse equal in width to the count-down input when the counter underflows. Similarly, the carry output produces a pulse equal in width to the count-down input when an overflow condition exists. The counters can then be easily cascaded by feeding the borrow and carry outputs to the count-down and count-up inputs respectively of the succeeding counter.

HD74192, SN74LS192
typical clear, load, and count sequences

Illustrated below is the following sequence:

1. Clear outputs to zero.
2. Load (preset) to BCD seven.
3. Count up to eight, nine, carry, zero, one, and two.
4. Count down to one, zero, borrow, nine, eight, and seven.
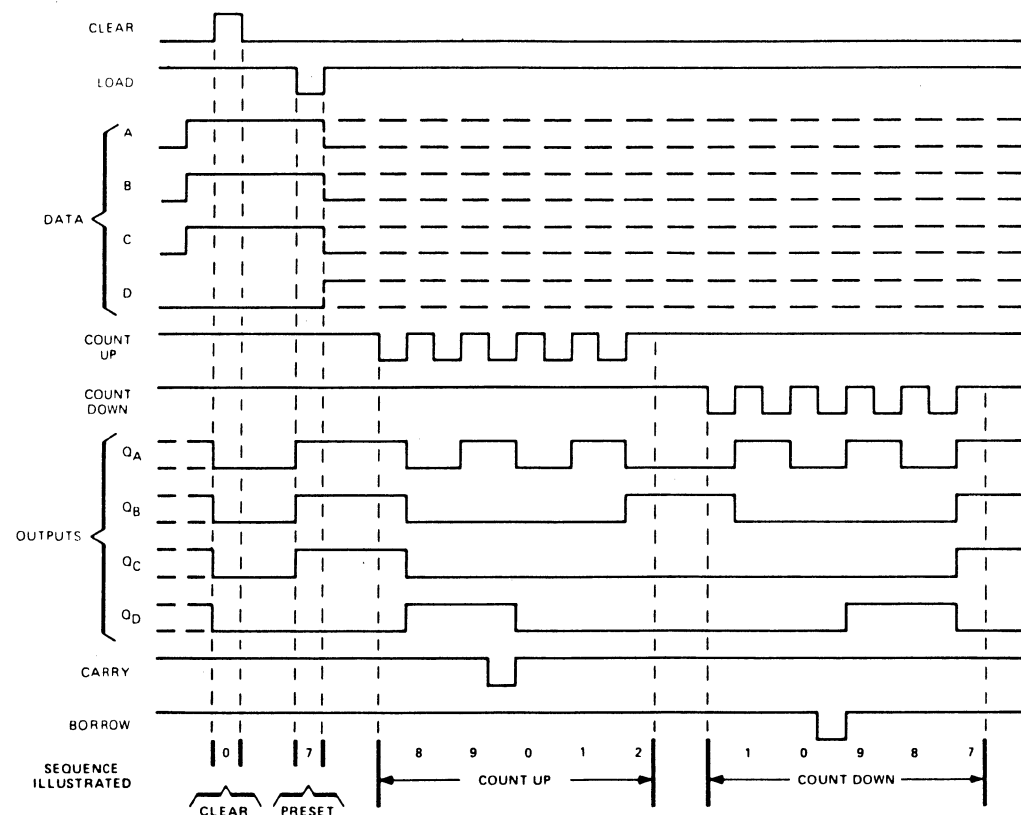
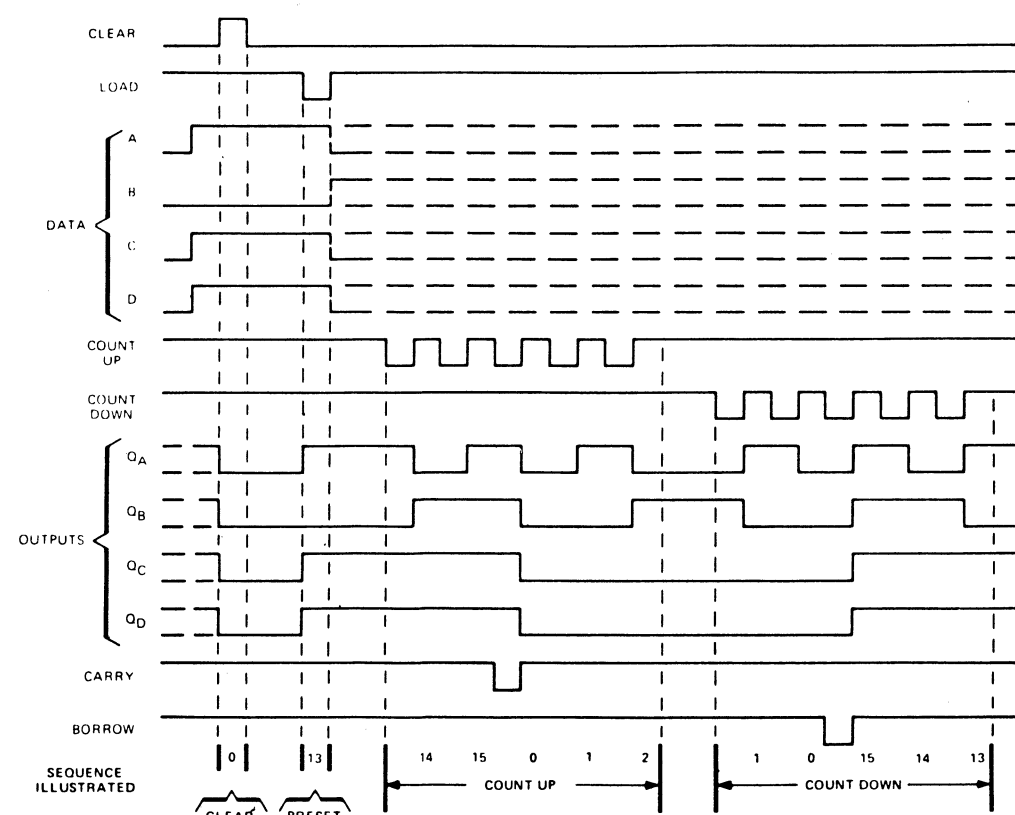NOTES: A. Clear overrides load, data, and count inputs.
B. When counting up, count-down input must be high; when counting down, count-up input must be high.

HD74193, SN74LS193, SN74193
typical clear, load, and count sequences

Illustrated below is the following sequence:

1. Clear outputs to zero.
2. Load (preset) to binary thirteen.
3. Count up to fourteen, fifteen, carry, zero, one, and two.
4. Count down to one, zero, borrow, fifteen, fourteen, and thirteen.

NOTES: A. Clear overrides load, data, and count inputs.
B. When counting up, count-down input must be high; when counting down, count-up input must be high.

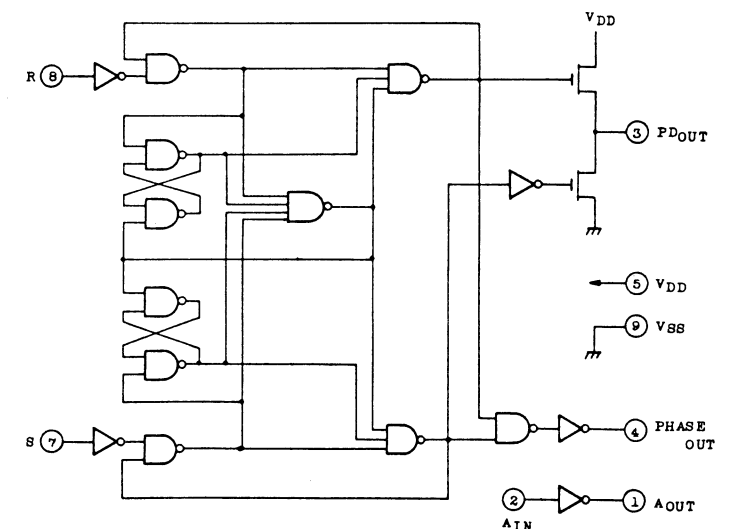## TC5081P
Phase Comparator and Amplifier
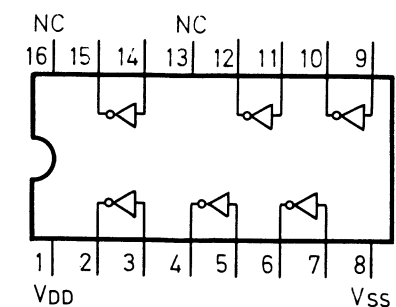### PIN CONNECTION
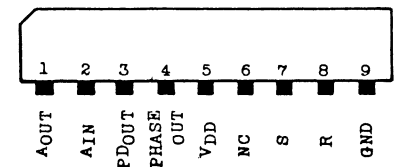
PHASE COMPARATOR TIMMING CHART
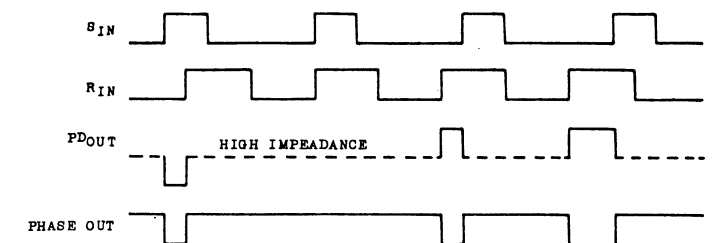
LOGIC DIAGRAM

TC4049B
Hex Buffer Converter Inverting Type
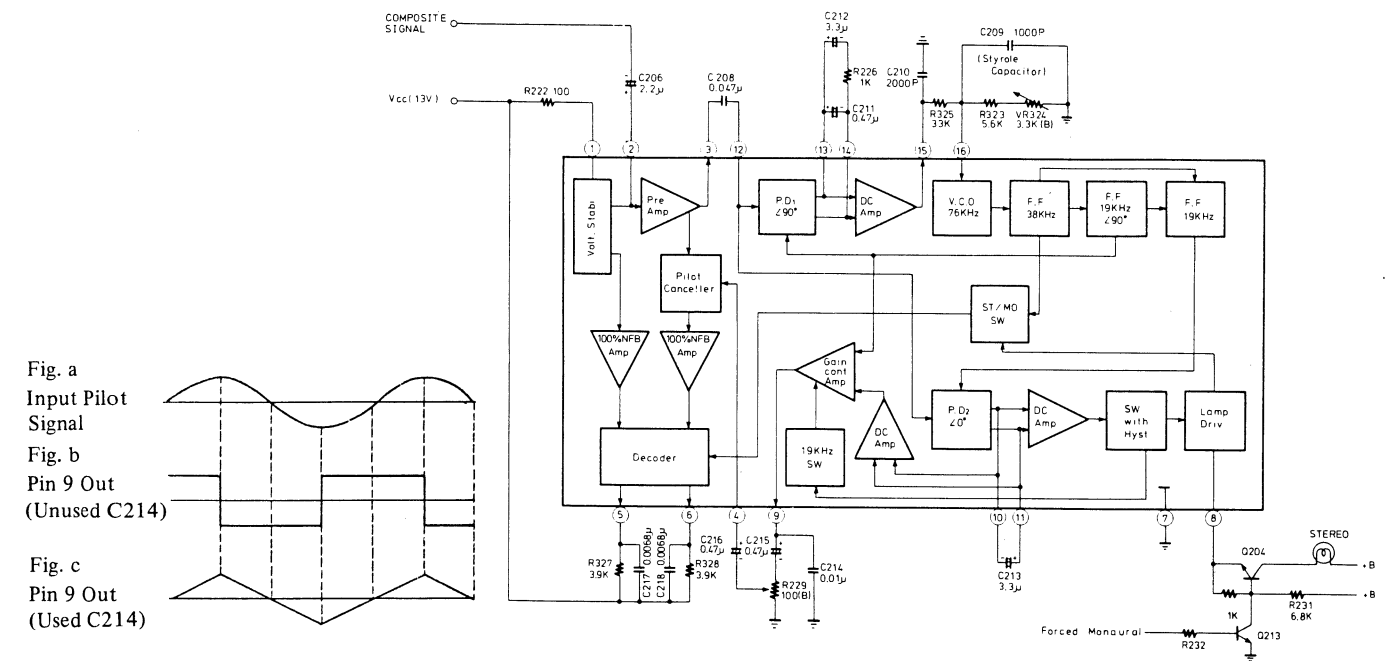### PIN ARRANGEMENT

TUNER-SCHEMATIC DIAGRAM

ONKYO CORPORATION

TUNER PC BOARD VIEW FROM BOTTOM SIDE

FRONT END PC BOARD VIEW FROM BOTTOM SIDE
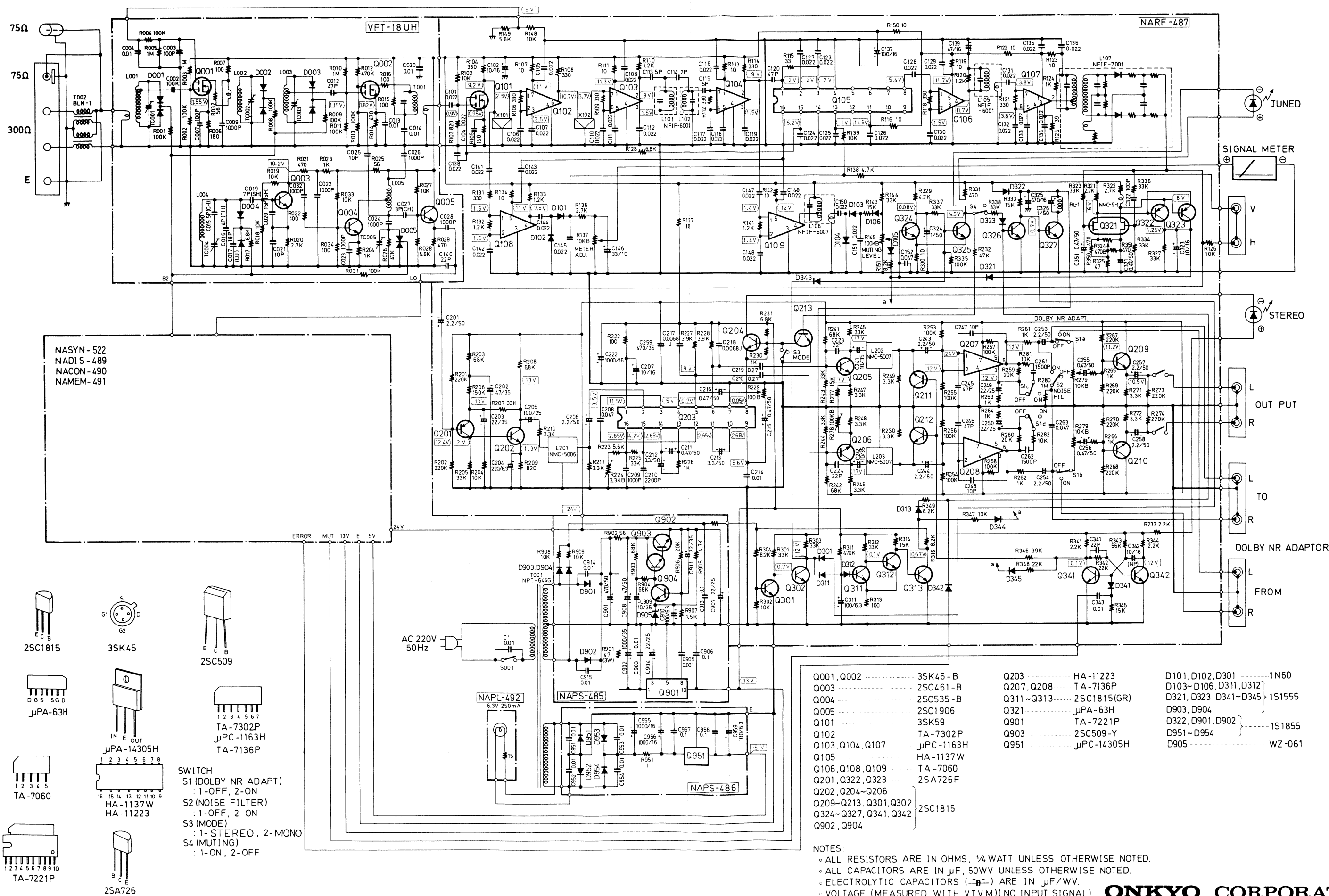
RF/IF AND MPX. PC BOARD
(NARF-487) -PARTS LIST

Circuit No.	Parts No.	Description
Front end		
	240039	VFT-18UH
ICs		
Q102	222452	TA-7302P
Q103, Q104	222474	μPC-1163H
Q107		
Q105	222421	HA-1137W
Q106, Q108	222407	TA-7060P
Q109		
Q203	222458	HA-11223
Q207, Q208	222423	TA-7136P
Transistors		
Q101	2211235	3SK59(GR), F.E.T
Q201, Q322	2210416	2SA726(F)
Q323		
Q202, Q204		
Q205, Q206		
Q209-Q213		
Q301, Q302	2211255	2SC1815(GR)
Q311-Q313		
Q324-Q327		
Q341, Q342		
Q321	2211282	μPA63(H)L, F.E.T.
Diodes		
D101, D102	223103	1N60
D301		
D103-D106		
D311-D313	223105	1S1555
D321, D323		
D341, D345		
D322	223802	1S1885
Transformers		
L101, L102	233096	NFIF-6001
L105		
L106	233125	NFIF-6007
L107	233127	NFIF-7001
Coils		
L201	233123	NMC-5006
L202, L203	233124	NMC-5007
L301	233031	NMC-9-1
Ceramic filters		
X101, X102	3010028	CFM107K14
Capacitor		
C102	352741001	10μF, 16V, Elect.
C139	352744701	47μF, 16V, Elect.
C201	352780221	2.2μF, 50V, Elect.
C202	352764701	47μF, 35V, Elect.
C203	352762201	22μF, 35V, Elect.
C204	352722211	220μF, 6.3V, Elect.
C205	352751011	100μF, 25V, Elect.
C206	352780221	2.2μF, 50V, Elect.
C207	352741001	10μF, 16V, Elect.
C209	372321025	1,000pF±10%, 50V, ST
C211	352784791	0.47μF, 50V, Elect.

Circuit No.	Parts No.	Description
C212, C213	352780331	3.3μF, 50V, Elect
C215, C216	352784791	0.47μF, 50V, Elect.
C219, C220	374122747	0.27μF±20%, 50V, DE
C222	352741021	1,000μF, 16V, Elect.
C241, C242	352761001	10μF, 35V, Elect.
C243, C244	352780221	2.2μF, 50V, Elect.
C249, C250	352752201	22μF, 25V, Elect.
C253, C254	352780221	2.2μF, 50V, Elect.
C257, C258		
C255, C256	352784791	0.47μF, 50V, Elect.
C259	352764711	470μF, 35V, Elect
C311	352721011	100μF, 6.3V, Elect.
C321	352784791	0.47μF, 50V, Elect.
C323	352741001	10μF, 16V, Elect.
C324	352780101	1μF, 50V, Elect.
C325	352744711	470μF, 16V, Elect.
C326	352780221	2.2μF, 50V, Elect.
C342	352941006	10μF, 16V, NP
C146	352733301	33μF, 10V, Elect.
C351	352784791	0.47μF, 50V, Elect.
Resistors		
R137	5225015	N10HR10KBD,SF
R145	5225016	N10HR100KBD,SF
R224	5225071	N10HR3.3KBIM,SF
R229	5225016	N10HR100KBD,SF
R278	5225016	N10HR100KBD,SF
R279	5172051	N24RGL10KB15H, Output level control
R324	5225026	N10HR470BD,SF
Switches		
S1-S4	25035073	NPS-422-L38
Terminals		
P1,P2	25045043	NPJ-4PDBL20
Relay		
RL1	25065048	FRL-644D12/2AS

NOTES: Capacitor
ST: Polystyren film capacitor
DE: Non-inductive polyester film capacitor
NP: Non-polar electrolytic capacitor
       Resistor
SF: Semi-fixed variable resistor

BLOCK DIAGRAM
HA11223 (PLL FM Stereo Demodulator with Pilot Cancel)

Fig. a
Input Pilot
Signal

Fig. b
Pin 9 Out
(Unused C214)

Fig. c
Pin 9 Out
(Used C214)

1. Pilot Cancel Circuit Operations

The composite signal inputed from pin 2 is amplified by the Pre-Amp circuit, and then it is outputed to pin 3. This signal is inputed to pin 12 and, one part is inputed to the PLL circuit and the other to the lamp driver circuit. The PLL circuit locks out the pilot signal by the signal which has been inputed to the PLL circuit, and the signal in the PLL circuit gererates three kinds of signals, 76 kHz, 38 kHz, and 19 kHz. The 19 kHz signal whose phase is advancing $90°$ more than the pilot signal is inputed to the Gain Control Amp.

On the other hand, the signal inputed to the lamp driver circuit is detected synchronously by the 19 kHz signal with the same phase as the pilot signal generated by the PLL circuit, and sent to pin 10 and pin 11 as a DC signal in proportion to the level of the pilot signal.

The DC signal is amplified by DC-Amp, and used as the control signal of the above mentioned Gain Control Amp. Therefore, when there is no load capacity C_{214} in the output of pin 9 that has been outputed from the Gain Control Amp., a rectangle wave with a phase of $90°$ advanced as compared with the input pilot signal will appear as indicated in the right figure b.

As a matter of fact, however, since there is C_{214}, a triangular wave that is in the same phase as the input pilot signal will appear as shown in Fig. C. The level of the triangular wave correlates with the input pilot signal level and it disperses due to dispersion of IC within the circuit. Therefore, it is necessary to adjust properly the level by R_{229} (100 ΩB). This level adjusted triangular wave is inputed to pin 4 and is phase inverted by the transistor into IC, then added to the input pilot signal.

Since the pilot cancel of HA11223 is utilizing the above mentioned triangular wave injection, when the difference between the pilot signal and the fundamental frequency component of the triangular wave is eliminated, the odd high harmonics of the triangular wave will remain.

This high harmonic components are, needless to say, the odd times of 19 kHz, but when this signal is turned on by switching transistors of the decoder, as the 38 kHz rectangular wave, it causes beat with the high harmonics that are the odd times of 38 kHz, and generates a signal of 19 kHz component again.

As a result of this, the signal of 19 kHz component that appears at the output pin becomes easier to be unbalanced at pin 5 and at pin 6. Therefore, for the above mentioned adjustments of R_{229}, it becomes necessary to make each 19 kHz component appearing at pin 5 and at pin 6 the same and to maximize them.
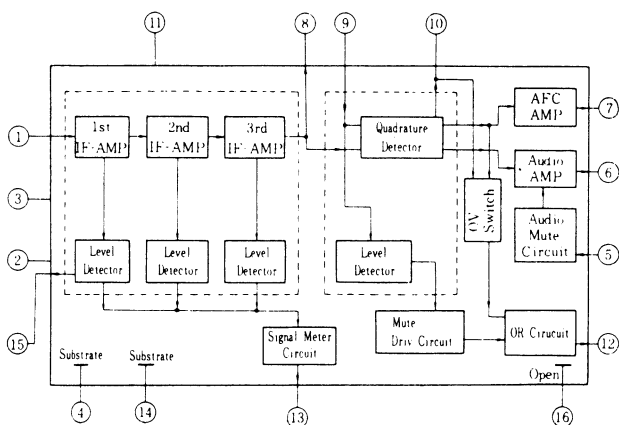
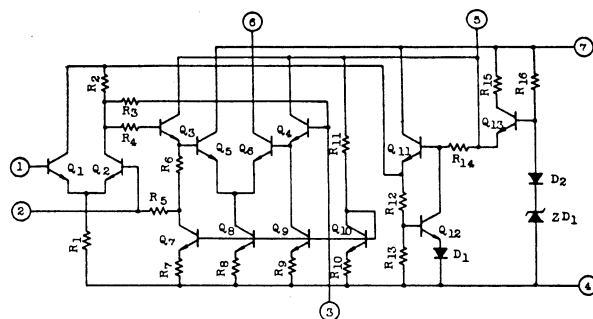**TA7221P** (Voltage regulator)
EQUIVALENT CIRCUIT
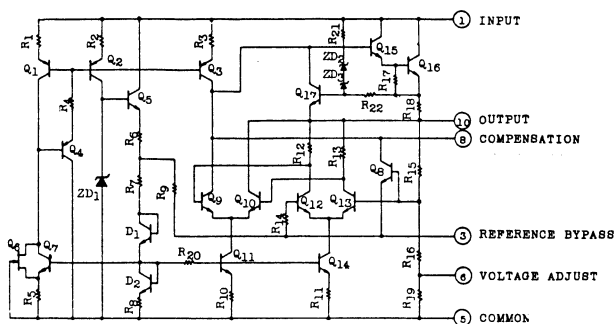
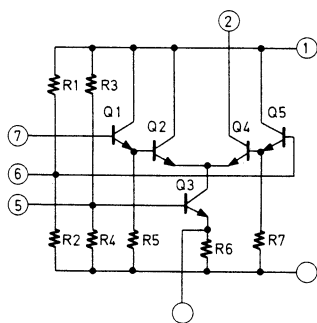**μPC14305H** (Voltage regulator)
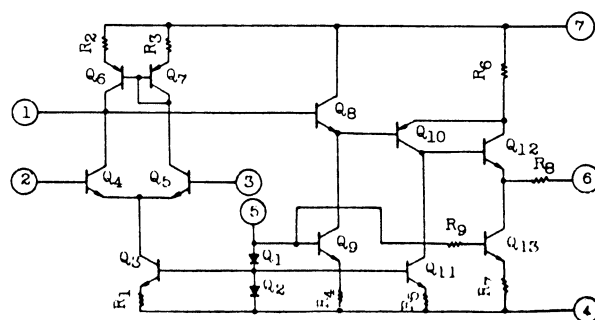**EQUIVALENT CIRCUIT**
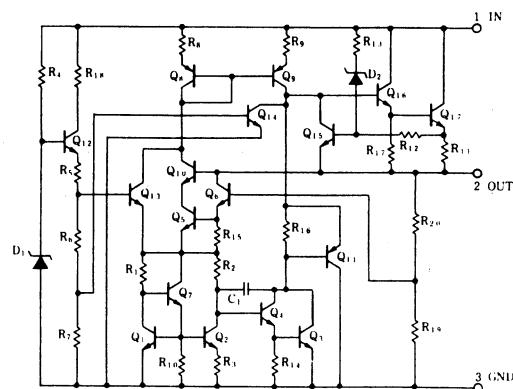
HA1137W (FM IF ampli. and Det.)
BLOCK DIAGRAM
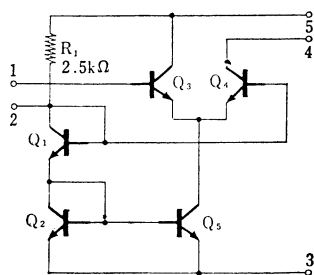

TA7302P (FM IF ampli.)
EQUIVALENT CIRCUIT

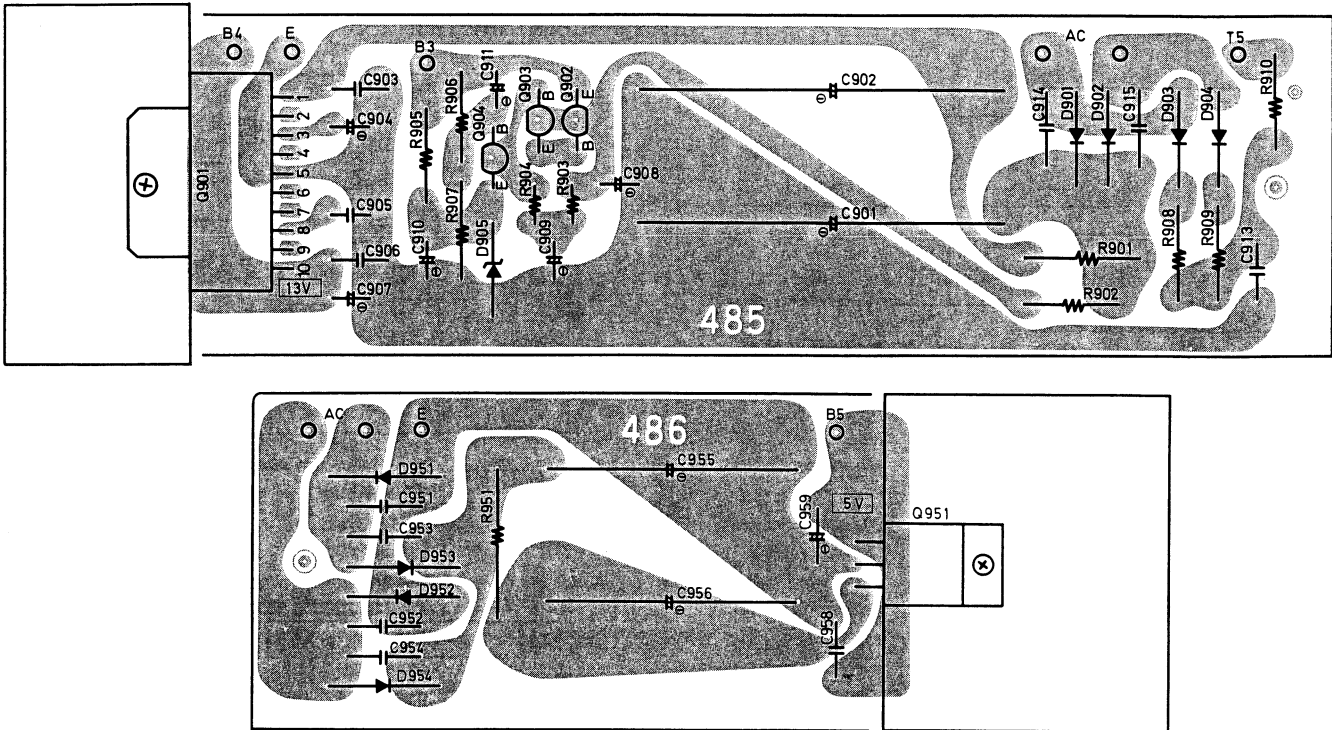**μPC1163H** (FM IF ampli.)
EQUIVALENT CIRCUIT

TA7136P (Preampli)
EQUIVALENT CIRCUIT

TA7060P (FM IF ampli.)
EQUIVALENT CIRCUIT

POWER SUPPLY PC BORD VIEW FROM BOTTOM SIDE

POWER SUPPLY PC BOARD (NAPS-485)-PARTS LIST

Circuit No.	Parts No.	Description
IC		
Q901	222472	TA-7221P
Transistors		
Q902	2210901	2SC509(Y)
Q903, Q904	2211255	2SC1815(GR)
Diodes		
D901-D904	223802	1S1885
D905	223928	WZ-061
Capacitors		
C901	351784711	470μF, 50V, Elect.
C902	351761021	1,000μF, 35V, Elect.
C904	352752201	22μF, 25V, Elect.
C907	352752201	22μF, 25V, Elect.
C908	352784701	47μF, 50V, Elect.
C909	352761001	10μF, 35V, Elect.
C910	352721011	100μF, 6.3V, Elect.
C911	352762201	22μF, 35V, Elect.
Resistor		
R901	441824704	47Ω, 3W, MOF
Radiator		
	27160039	RAD-09

POWER SUPPLY PC BOARD (NAPS-486)-PARTS LIST

Circuit No.	Parts No.	Description
IC		
Q951	222496	μPC14305H
Diodes		
D951-D954	223802	1S1885
Capacitors		
C955, C956	351741021	1,000μF, 16V, Elect.
C959	325721011	100μF, 6.3V, Elect.
Resistor		
R951	451730104	1Ω, 2W, Metal
Radiator		
	27160038	RAD-08

BLOCK DIAGRAM
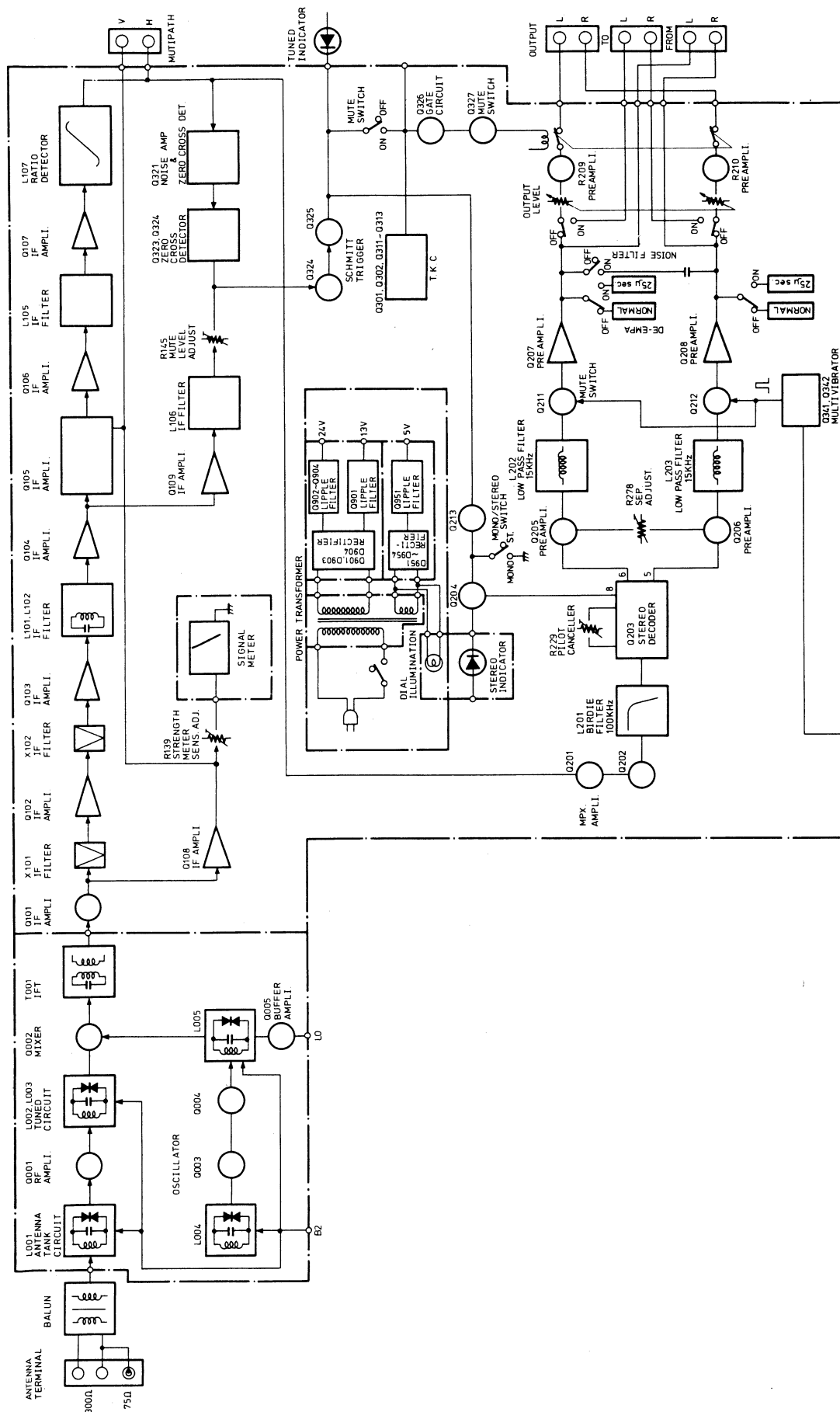
PACKING PROCEDURES
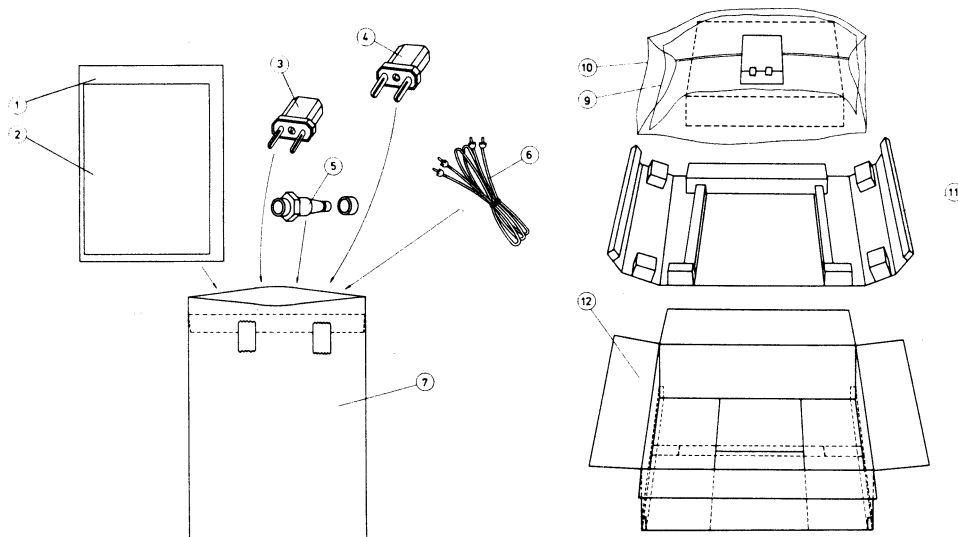
PACKING PROCEDURES-PARTS LIST

Ref. No.	Parts No.	Description
1	29340262	Instruction manual
2	29365005	Warranty card (V)
	29380034	Sticker (G)
3	292005	CV-C, Conversion plug
4	292006	CV-BS, Conversion plug (G)
5	25055004	FP-3, Coaxial connector
6	2010034	Pin plug cord
7	29100006	250 x 350mm, Poly bag
8	13752119	Accessory bag complete (V)
	13745119	Accessory bag complete (G)
9	29095012	500 x 800mm, Protection sheet
10	29100019A	550 x 850mm, Poly bag
11	29090229	Pad
12	29050187	Carton box
	29380042	Label (B) (Back panel)
	27300107	Programming stylus

(V) : German Model
(G) : Europe Model

Printed in Japan N807